

CLAIMS

1. An organic waste material treatment process for organic waste material received in a vessel comprising the steps of:

a) subjecting the contents of the vessel to conditions under which aerobic  
5 composting of the contents of the vessel will proceed in order to raise the temperature of the contents of the vessel to between 15-75°C to promote anaerobic digestion of the contents;

b) depleting oxygen in the vessel to create conditions suitable for anaerobic digestion of the contents to proceed;

10 c) adding an anaerobic bacterial inoculum to the contents of the vessel;

d) anaerobically digesting the contents of the vessel;

e) separating gaseous byproducts from residues resulting from step d);

f) removing at least a portion of residual water from the vessel;

15 g) evenly distributing air to the residues in the vessel to create conditions suitable for aerobic composting of the residues to proceed without agitating the contents of the vessel;

h) aerobically composting the residues by action of aerobic bacteria; and

i) recovering compost resulting from step h) from the vessel.

2. The organic waste material treatment process according to claim 1, characterised  
20 in that the temperature of the contents of the vessel is raised to at least 50 °C before commencement of step d).

3. The organic waste material treatment process according to claim 1 or claim 2, characterised in that air is administered to the contents of the vessel before commencement of step a).

4. The organic waste material treatment process according to claim 3, characterised in that air is administered to the contents of the vessel at a pressure of between 1-1000kPa above atmospheric pressure to ensure even penetration of the contents of the vessel by the air.
5. The organic waste material treatment process according to claim 4, characterised in that air is administered to the contents of the vessel at a pressure of between 5 - 50 kPa above atmospheric pressure to ensure even penetration of the contents of the vessel by the air.
6. The organic waste material treatment process according to claim 4 or claim 5, characterised in that air is administered to the contents of the vessel at about 25 kPa above atmospheric pressure
7. The organic waste material treatment process according to any one of claims 1 to 6, characterised in that water is added to the contents of the vessel to adjust a moisture content of the contents of the vessel to between about 40 - 60 % wet weight (w/w) before commencement of step a).
8. The organic waste material treatment process according to any one of claims 1 to 7, characterised in that oxygen in the vessel is depleted at step b) by sealing the vessel and ceasing administration of air to the contents of the vessel, thereby providing no further oxygen reserves for aerobic bacteria therein, thus causing the aerobic bacteria to consume the oxygen remaining in the vessel.
9. The organic waste material treatment process according to any one of claims 1 to 8, characterised in that air is administered to the residues at step g) at a pressure of between 1-1000 kPa above atmospheric pressure to ensure even penetration of the residues by the air.

10. The organic waste material treatment process according to claim 9, characterised in that air is administered to the residues at step g) at a pressure of between 5 - 50 kPa above atmospheric pressure to ensure even penetration of the residues by the air.
- 5 11. The organic waste material treatment process according to claim 9 or claim 10, characterised in that air is administered to the residues at step g) at a pressure of about 25 kPa above atmospheric pressure to ensure even penetration of the residues by the air.
- 10 12. The organic waste material treatment process according to any one of claims 1 to 11, characterised in that the portion of water removed from the vessel in step f) results in a moisture content of the residues of between 40 - 60 % wet weight (w/w).
- 15 13. The organic waste material treatment process according to any one of claims 1 to 12, characterised in that the gaseous byproducts separated from the residues in step e) include methane.
14. The organic waste material treatment process according to any one of claims 1 to 13, characterised in that the compost resulting from step h) has been aerobically stabilised.
- 20 15. An organic waste material treatment process for organic waste material received in a plurality of interconnected vessels comprising the steps of:
  - a) subjecting the contents of the or each vessel to conditions under which aerobic composting of contents will proceed in order to raise the temperature of the contents to between 15-75°C to promote anaerobic digestion of the contents;
  - b) depleting oxygen in the or each vessel to create conditions suitable for anaerobic
- 25 digestion of the contents to proceed;

- 5 c) adding water received from an interconnected vessel to the or each vessel to create conditions suitable for anaerobic digestion of the contents to proceed in the or each vessel, whereby the contents of the interconnected vessel has already undergone anaerobic digestion and the water contains an anaerobic bacterial inoculum;
- d) anaerobically digesting the contents of the or each vessel;
- e) separating gaseous byproducts from residues resulting from step d);
- f) removing at least a portion of the water from the or each vessel and transferring the portion of the water to another interconnected vessel for use in step c);
- 10 g) evenly distributing air to the residues in the or each vessel to create conditions suitable for aerobic composting of the residues to proceed without agitating the contents of the vessel;
- h) aerobically composting the residues; and
- i) recovering compost resulting from step h) from the or each vessel.
- 15 16. The organic waste material treatment process according to claim 15, characterised in that the temperature of the contents of the or each vessel is raised to at least 50 °C before commencement of step d).
17. The organic waste material treatment process according to claim 15 or claim 16, characterised in that air is administered to the contents of the or each vessel before
- 20 commencement of step a).
18. The organic waste material treatment process according to claim 17, characterised in that air is administered to the contents of the or each vessel at a pressure of between 1-1000 kPa above atmospheric pressure to ensure even penetration of the contents of the or each vessel by the air.

19. The organic waste material treatment process according to claim 18, characterised in that air is administered to the contents of the or each vessel at a pressure of between 5 - 50 kPa above atmospheric pressure to ensure even penetration of the contents of the or each vessel by the air.

5 20. The organic waste material treatment process according to claim 18 or claim 19, characterised in that air is administered to the contents of the or each vessel at about 25 kPa above atmospheric pressure

21. The organic waste material treatment process according to any one of claims 15 to 20, characterised in that water is added to the contents of the or each vessel to  
10 adjust a moisture content of the contents of the or each vessel to between 40 - 60 % wet weight (w/w) before commencement of step a).

22. The organic waste material treatment process according to any one of claims 15 to 21, characterised in that oxygen in the or each vessel is depleted by sealing the or each vessel and ceasing administration of air to the contents of the or each vessel,  
15 thereby providing no further oxygen reserves for aerobic bacteria therein, thus causing the aerobic bacteria to consume the oxygen remaining in the or each vessel.

23. The organic waste material treatment process according to any one of claims 15 to 22, characterised in that air is administered to the residues at step g) at a pressure  
20 of between 1-1000 kPa above atmospheric pressure to ensure even penetration of the residues by the air.

24. The organic waste material treatment process according to claim 23, characterised in that air is administered to the residues at step g) at a pressure of between 5 -50 kPa above atmospheric pressure to ensure even penetration of the residues by the  
25 air.

25. The organic waste material treatment process according to claim 23 or claim 24, characterised in that air is administered to the residues at step g) at a pressure of about 25 kPa above atmospheric pressure to ensure even penetration of the residues by the air.
- 5 26. The organic waste material treatment process according to any one of claims 15 to 25, characterised in that the portion of water removed from the or each vessel in step f) results in a moisture content of the residues of between 40 - 60 % wet weight (w/w).
- 10 27. The organic waste material treatment process according to any one of claims 15 to 26, characterised in that the gaseous byproducts separated from the residues in step e) include methane.
28. The organic waste material treatment process according to any one of claims 15 to 27, characterised in that the compost resulting from step h) has been aerobically stabilised.
- 15 29. A vessel for sequential anaerobic digestion and aerobic composting of organic waste material arranged, in use, to facilitate an organic waste treatment process as claimed in any one of claims 1 to 28, comprising a means for receiving organic waste material, first feed means for supplying water to the vessel and second feed means for supplying air to the vessel, wherein the first and second feed means are arranged to evenly distribute water and air to the organic waste material; the vessel being devoid of any internal agitation means.
- 20 30. The vessel according to claim 29, characterised in that the first and second feed means include a plurality of feeder lines disposed in at least one wall of the vessel to facilitate the supply of air and water evenly to the organic waste material.

31. The vessel according to claim 29, characterised in that the first and second feed means includes at least one elongate perforated lance depending from an uppermost wall or a lowermost wall of the vessel to facilitate the supply of air and water evenly to the organic waste material.

5 32. The vessel according to any one of claims 29 to 31, characterised in that the vessel is provided with a gas extraction line to extract gases generated in the interior of the vessel during anaerobic digestion of the organic waste material or to extract surplus gases upon completion of aerobic composting of the organic waste material.

10 33. The vessel according to any one of claims 29 to 32, characterised in that the vessel is constructed to withstand internal pressures of between about 1-1000 kPa above atmospheric pressure.

15 34. The vessel according to any one of claims 29 to 33, characterised in that the second feed means supplies pressurised air to the vessel in a range of between about 1-1000 kPa above atmospheric pressure such that the pressurised air evenly penetrates the organic waste material.

20 35. The vessel according to claim 34, characterised in that the second feed means supplies pressurised air to the vessel in a range of between about 5 - 50 kPa above atmospheric pressure such that the pressurised air evenly penetrates the organic waste material.

36. The vessel according to claim 34 or claim 35, characterised in that the second feed means supplies pressurised air to the vessel at about 25 kPa above atmospheric pressure.

37. The vessel according to any one of claims 29 to 36, characterised in that the vessel is provided with a drainage means to remove at least a portion of water supplied to the vessel by the first feed means.

38. An apparatus arranged, in use, to facilitate an organic waste material treatment process as claimed in any one of claims 1 to 28, comprising at least one vessel for sequential anaerobic digestion and aerobic composting of organic waste material as claimed in any one of claims 29 to 37, a first recirculation means for recirculating gases extracted from the or each vessel to a first storage means, and a second recirculation means for recirculating water extracted from the or each vessel to a second storage means or an interconnected vessel, wherein the organic waste material in the interconnected vessel is undergoing anaerobic digestion.

39. The apparatus according to claim 38, characterised in that the first storage means is a gas storage tank for storing biogas extracted during anaerobic digestion of the organic waste material in the or each vessel.

40. The apparatus according to claim 38 or claim 39, characterised in that the second storage means is a water storage tank for storing water extracted after anaerobic digestion of the organic waste material in the or each vessel.

41. The apparatus according to claim 40, characterised in that water stored in the water storage tank is recirculated to the interconnected vessel by the second recirculation means, wherein the organic waste material in the interconnected vessel is undergoing anaerobic digestion.

42. The apparatus according to claim 40, characterised in that water stored in the water storage tank is subsequently recirculated back to the vessel by the second recirculation means, wherein a subsequent batch of organic waste material is undergoing anaerobic digestion.



43. The apparatus according to any one of claims 38 to 42, characterised in that the first recirculation means is interconnected to a dewatering tank, the dewatering tank being arranged, in use, for removal of water from the extracted gases.

44. The apparatus according to claim 43, characterised in that the dewatering tank is  
5 interconnected to the second recirculation means for recirculating the water removed from the extracted gases to the second storage means or the interconnected vessel.

45. The apparatus according to any one of claims 38 to 44, characterised in that the second storage means is provided with a heating means for heating water stored in  
10 the second storage means, the heating means being interconnected by the first recirculation means to the gas storage tank, such that, in use, methane gas stored in the gas storage tank is utilised by the heating means to transfer heat to the water stored in the second storage means.

46. The apparatus according to any one of claims 38 to 45, characterised in that the  
15 first recirculation means is interconnected to a heat exchange means, the heat exchange means being arranged, in use, to facilitate transfer of heat energy from hot air extracted from the or each vessel, wherein the organic waste material in the or each vessel is undergoing aerobic composting.